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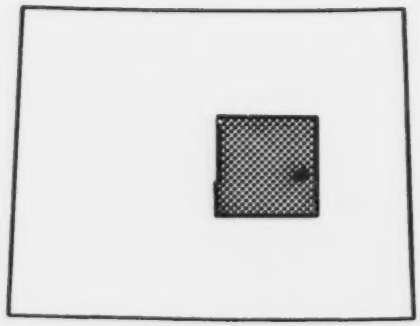
FLOOD INSURANCE STUDY

CITY OF CASPER, WYOMING
NATRONA COUNTY



OCTOBER 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 560037

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Flood Boundary and Floodway Map — Panels 560037 0005C-0010C-0015C

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map — Panels 560037 0005C-0010C-0015C

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FLOOD INSURANCE STUDY
CITY OF CASPER, WYOMING

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Casper, Natrona County, Wyoming, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Casper to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some States or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at Section 60.1(d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers under the Inter-Agency Agreement Nos. IAA-H-19-74, Project Order No. 17 and IAA-H-16-17, Project Order No. 6 for FEMA. This study was completed in October 1976.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the study contractor, FEMA, and representatives of Casper. Results of the hydrologic analyses were coordinated with the City Council Chambers of the City of Casper, Wyoming.

The results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA and community officials. The study was acceptable to the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Casper, Natrona County, Wyoming. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Casper were determined by FEMA with the community and study contractor consultation.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through 1987.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Casper.

2.2 Community Description

The first white man's cabin in Wyoming was constructed by Robert Stuart's party of Astorians. Stuart and party left Astoria, Oregon on June 12, 1812, en route to St. Louis, Missouri, to report to John Jacob Astor, but stopped near Bessemer Bend, and constructed a cabin with the intention of spending the winter. When the cabin was discovered by Indians, the Astorians left in the night and traveled east down the North Platte River. The trail explored by Stuart became known as the Oregon Trail, and between 1840 and 1870 many immigrants used this trail that parallels the North Platte River through most of the study area. These immigrants crossed the river at the present site of Casper.

Ranching began in the area when Judge Joseph M. Carey trailed 15,000 head of cattle into the valley in 1876, and constructed the first ranchhouse on the C.Y. Ranch. In 1888, Judge Carey designated part of the C.Y. meadowland as a site for a new town and Casper was formed. The Town of Bessemer was also formed in 1888 and competed with Casper for the county seat of Natrona County when that county was separated from Carbon County. Casper was awarded the county seat and Bessemer disappeared. The C.Y. and other ranches were the mainstay of the county's economy until 1890, when oil was discovered. Oil, agriculture, and tourism now provide most of the economic base for the area. Casper also provides banking and commercial services to the area. Casper is served by U.S. Highways 20, 26, and 87, Interstate Highway 25, Wyoming State Highway 220, the Casper Air Terminal, the Burlington Northern Railroad, and the Chicago and North Western Railway. The city is located in east-centeral Natrona County on the eastern side of the Continental Divide.

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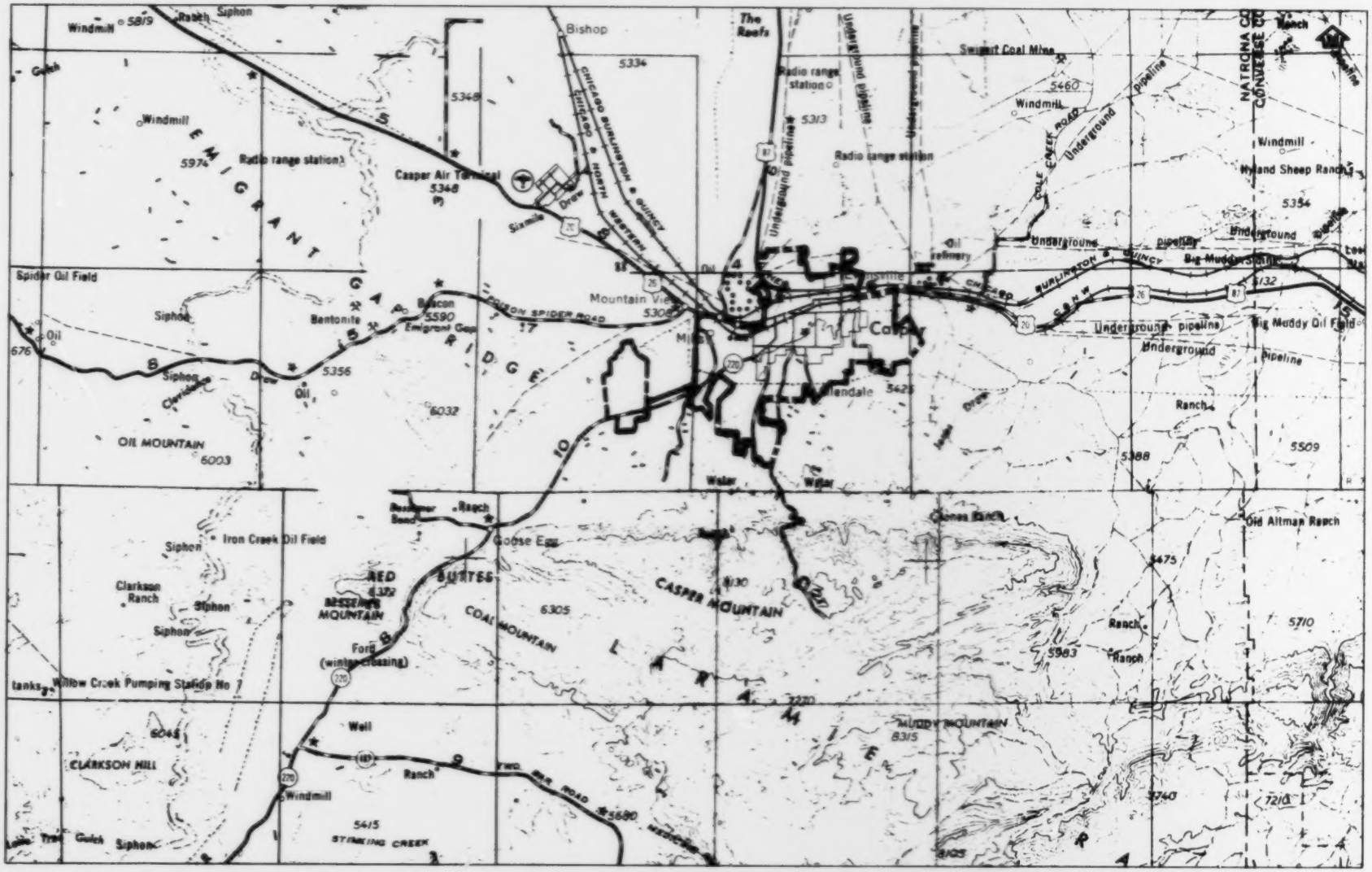

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY

(NATRONA CO.)

APPROXIMATE SCALE

5 0 5 10 15 MILES

VICINITY MAP

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The climate in the Casper area is characterized by cold winters and dry, hot summers. The normal annual precipitation is 14.09 inches; the bulk of the precipitation is received during the spring months, mostly in the form of rain.

The Casper area is rich in natural resources. The North Platte River and its tributaries in the vicinity of Casper are used for recreation, fish and wildlife, irrigation, and municipal and industrial water supply. Vegetation around Casper is fairly typical of central Wyoming. Fir and pine predominate at the higher elevations and grasslands predominate at the lower elevations with trees and shrubs along the streambanks.

Casper is located in the center of Wyoming's oil, uranium, and coal fields. In the future, as coal and uranium production increase, the city is expected to be the regional center for the coal industry because of its location, transportation facilities, and financial services. This will undoubtedly create population increases. Table 1 contains population projects for the Casper urban area.

TABLE 1. City of Casper Population (Reference 5)

1970	1980	1990	2000
39,361	51,016	72,850	100,650

The flood plains abound with commercial, industrial, and residential developments as well as public utilities. Numerous city streets, state highways, and rail lines cross the flood plains. Continuing economic development within the study area is expected and pressures leading to intensified flood plain use will undoubtedly accompany such development.

The North Platte River has its headwaters in the mountains of the North Park area of Jackson County, Colorado. Elevations in the basin range from 12,180 feet National Geodetic Vertical Datum of 1929 (NGVD) on Mount Zirkel near Walden, Colorado, to a river elevation of approximately 5100 feet NGVD in Casper. The North Platte River drains an area of 16,500 square miles upstream from Casper. The North Platte River flood plain within the Casper city limits is used mainly for industrial, commercial, and residential development.

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Garden Creek has its source on Casper Mountain south of Casper. The basin has a drainage area of approximately 10 square miles and ranges in elevation from 8100 feet to 5100 feet NGVD. From the mouth of Garden Creek to the Casper city limits, the Garden Creek flood plain is almost exclusively occupied by residential development.

Sage Creek has a drainage area of approximately 4.5 square miles and originates on the north slope of Casper Mountain. Basin elevations range from 6040 feet to 5100 feet NGVD. Land use in the Sage Creek flood plain is almost entirely industrial downstream from Interstate Highway 25 with residential area predominating upstream from Interstate Highway 25 to the Casper city limits.

Squaw Creek has its source on Casper Mountain, south of Casper. The basin has a drainage area of approximately 3.2 square miles and ranges in elevation from 7760 feet to 5120 feet. The Squaw Creek flood plain is occupied by moderate residential development.

Wolf Creek, lying just to the east of Squaw Creek, drains a basin area of 4.7 square miles and ranges in elevation from 7860 to 5120 feet. Grassland and some sparse residential development occupy the Wolf Creek flood plain.

Eastdale and Glendale Creeks are both relatively small in areal extent with each having a drainage basin of approximately 3 to 4 square miles in area. They both have their source at about elevation 6000 feet NGVD on the north slope of Casper Mountain. The flood plain of both streams is generally occupied by residential and recreational areas with some commercial development interspersed.

2.3 Principal Flood Problems

The major flood problems of the Casper area are concentrated along several creeks which rise near Casper Mountain and flow northward to the North Platte River. These creeks, directly affecting the City of Casper, are Garden Creek, Sage Creek, Eastdale Creek, and Glendale Creek. Stream gaging records are not available on any of these streams; however, they have historically produced severe flooding within the present Casper corporate limits.

Flooding along these streams is normally produced by high intensity rainfall and characterized by a peak discharge of relatively short duration, thus making flood fighting and evacuation extremely difficult.

Several floods have occurred on these streams. The greatest flood of record occurred in July 1895, when a 20-foot high wall of water purportedly swept down Garden Creek. A group of settlers camped near present day Westwood School were caught in the flood, resulting in three drownings. Other floods along these streams occurred in 1919, 1928, 1944, 1961, 1967, 1968, and 1973.

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A late afternoon thunderstorm on July 6, 1971, centered west of Casper, caused considerable flash flooding. The heaviest damage was reported in suburban Red Butte village. Some homes were demolished. The West Fork of Garden CReek received rainfall sufficient to cause Garden Creek to run bankfull, but no severe damages were sustained. The drainage areas of Glendale, Eastdale, and Sage Creeks escaped the brunt of this storm and experienced little overflow or damage.

Two inches of precipitation in approximately 2 hours were experienced in Casper shortly after noon on July 15, 1967. Flash flooding occurred throughout the southern portion of the city. Floodwaters flowed down streets, flooded yards, filled basements, and damaged utilities. Glendale Avenue, in east Casper, was turned into a 5-foot deep torrent. Large sections of pavement were ripped up by the force of the water. Widespread flooding occurred along Garden Creek downstream from 25th Street to Cy Avenue. Overtaxed sewers erupted through manholes in several areas a huge volumes of water swept through the system. Newspaper estimates indicated that the damage in Casper from floods along or in the vicinity of Garden, Glendale, Eastdale, and Sage Creeks totaled approximately $1 million. Much of this damage resulted from interior drainage problems.

Over 1.5 inches of rain fell in less than 1 hour during the afternoon of July 16, 1968. Flooding on or in the vicinity of Garden, Glendale, Eastdale, and Sage Creeks damaged home, lawns, streets, automobiles, and utilities. The extent of flooding and damages sustained were not as extensive as for the 1967 flood. Like the 1967 flood, much of the damage resulted from interior drainage problems.

The North Platte River at Casper does not have a history of extensive open channel flooding. This lack of damaging floods in the vicinity of the North Platte River is due to the combination of upstream reservoir regulation, the relatively large channel capacity, and the fortunate absence in the past of the hydrometeorological conditions capable of producing a large flood event. The most frequent flooding along this particular segment of the North Platte River is a direct result of ice effects. Slush ice forms in the winter during freeze-up periods when the temperature drops to the zero range for several days. This floating ice collects at constrictions gradually covering the river with solid ice. During warming trends, when ice breakup occurs, ice jams can form readily, forcing the river to flow onto the flood plain.

Casper is subject to intense local thunderstorms which create local runoff in excess of storm sewer capacity. This results in water flowing down streets and minor drainageways throughout Casper. In the Fort Casper Addition, the lack of a storm sewer system and the locally constructed levee along Garden Creek contribute to the flood problem. Along Sage Creek, a high groundwater level causes seepage in residential basements and results in the accumulation of alkali

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deposits in low-lying areas, thus causing some yard damage. Depths of flooding associated with this phenomenon are normally less than 1.0 foot. Photographs in Figures 2 through 7 illustrate flooding from local runoff as well as flooding along streams included in this Flood Insurance Study.

2.4 Flood Protection Measures

The City of Casper has undertaken numerous improvements along Garden, Glendale, and Sage Creeks. Downstream from Bellaire Drive, the Garden Creek channel has been realigned and levees have been constructed along both banks. This improved channel has adequate capacity for carrying floods of a large magnitude, but the channel upstream from the project is inadequate and floodwaters are spilled overbank before the water reaches the improved channel.

The Golf Course Dam and Reservoir was constructed on Glendale Creek by the city in 1922. This dam, according to a report by the Soil Conservation Service (Reference 4) stores approximately 1.7 times the amount of runoff expected from a 100-year flood event. In 1972, the City of Casper enlarged the channel of Sage Creek from Lillian to Second Streets. This improvement, with the existing city right-of-way along Sage Creek, will alleviate much of the flood damages that have been experienced by private individuals in the past. It provides approximately 100-year flood protection.

Five reservoirs are located on the North Platte River upstream from Casper. Seminoe Reservoir is formed by a concrete-arch dam completed in 1939, and is used for power and irrigation. The capacity of Seminoe Reservoir is 1,011,000 acre-feet. Kortes Reservoir, completed in 1950, is a power generation reservoir with a capacity of 4765 acre-feet. Pathfinder, an irrigation reservoir, was formed by the construction of a masonry dam in 1909 and has a capacity of 1,016,000 acre-feet. The alcova rock-filled dam was completed in 1938 and forms an irrigation and power reservoir with a total capacity of 184,400 acre-feet. Gray Reef, a small rock-fill dam completed in 1961, is used as an irrigation regulation dam and has a total capacity of 1804 acre-feet. The nature of these five dams is such that they would provide some protection from flood flows.

The City of Casper passed a flood plain zoning law in August 1971. Existing developments along the flood plains of Garden, Glendale, Eastdale, and Sage Creeks and along the North Platte River will preclude the effective use of flood plain zoning. Existing development will continue to be subject to damages from future floods.

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Figure 2. Garden Creek, Looking North from the Cy Avenue Bridge, July 16, 1968 (Courtesy of the Casper Star-Tribune)

Figure 3. Eastdale Creek, Flooding Near Glendale Avenue and 15th Street, May 5, 1973

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Figure 4. Eastdale Creek, Flooding Near Glendale Avenue and 15th Street, May 1973

Figure 5. Eastdale Creek, Flooding Near Glendale Avenue and 16th Street, May 9, 1973

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Figure 6. Local Runoff in Excess of Storm Sewer Capacity Near Poplar Street and Cy Avenue, July 15, 1967 (Courtesy of the Casper Star-Tribune)

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Figure 7. Local Runoff in Excess of Storm Sewer Capacity Near East Second Street and Grant Street, July 16, 1968 (Courtesy of the Casper Star-Tribune)

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3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, or being equalled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (4 in 10), and for any 90-year period, the risk increases to about 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

Discharge-frequency relationships for the North Platte River, Garden Creek, and Sage Creek were taken from previously published Flood Plain Information reports (References 1, 2, and 3). The methods used in these reports are described in the following paragraphs.

The discharge-frequency relationships for the North Platte River were based on a statistical analysis of the stream gaging record on the North Platte River at Alcova, Wyoming (drainage area is 14,711 square miles), the data presented in the "Missouri River Basin Comprehensive Framework Study" (Reference 6), and the results of a regional analysis of 15 gaged streams in east-central Wyoming. The results were checked by developing a discharge probability curve for the North Platte River at the Casper gaging station which had a 21-year gaging record.

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Garden Creek, Squaw Creek, Wolf Creek, and Sage Creek do not have gaging records. The discharge-frequency relationships for Garden and Sage Creeks were developed using regional analysis techniques based upon data available on similar streams having gaging records.

A summary of drainage area-peak discharge relationships for each stream studied in detail is shown in Table 1.

TABLE 2 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (Sq. Miles)	PEAK DISCHARGES (cfs) 10-Year	50-Year	100-Year	500-Year
NORTH PLATTE RIVER					
Upstream limit of study reach	15,700	7,000	10,400	12,200	41,000
Downstream of Casper Creek	16,500	7,800	11,800	14,400	43,000
SAGE CREEK					
Mouth to C. & N.W. RY Tracks to	4.5	300	800	1,100	3,720
15th Street to	3.7	250	700	910	3,090
Upstream Limit of Study	1.7	200	500	660	2,150
GARDEN CREEK					
Mouth to Cy Avenue	9.4	500	1,250	1,720	5,900
to 25th Street	8.3	460	1,130	1,580	5,500
to Upstream Limit of Study	6.7	450	1,050	1,430	4,800
SQUAW CREEK					
At Confluence With North Platte River	3.1	234	655	842	1,240
WOLF CREEK					
At Confluence With North Platte River	4.7	295	825	1,060	1,540

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flood sources.

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Cross sections for streams were either field surveyed or determined from detailed topographic maps (Reference 9). All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Channel roughness factors (Manning's "n") for Garden Creek and Sage Creek were assigned on the basis of inspection and engineering judgment. The values for the North Platte River were assigned utilizing stage-discharge data (Reference 3).

Starting water-surface elevations for the North Platte River were developed utilizing normal depth computations. Those for Garden Creek, Squaw Creek, Wolf Creek, and Sage Creek were based on stage-discharge curves developed on the North Platte River at the confluence with the respective streams.

Water-surface profiles were developed using a HEC-2 step-backwater computer model (Reference 7). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

Garden Brook, downstream of Bellaire Drive, is leveed on both sides. During high floods, a major portion of floodwaters from upstream areas flow around the levees and create sheet flow with an estimated depth of 2 feet in that region. Because of this the flood profiles for the 50-, 100-, and 500-year floods downstream of Bellaire Drive coincide.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. Therefore, the flood elevations, as shown on the profiles, are considered valid only if hydraulic structures remain unobstructed.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

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4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using U.S. Geological Survey 7.5-minute quadrangle mapping at a scale of 1:24,000 with a contour interval of 20 feet (Reference 9).

In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For each stream studied by approximate methods, the 100-year flood boundaries were developed using data supplied by the City of Casper and gleaned from a Soil Conservation Service report (Reference 4), as well as from field inspection and U.S. Geological Survey 7.5-minute quadrangle maps (Reference 9). No flood boundary has been shown for that portion of Glendale Creek downstream from the Golf Course Dam because Reference 4 indicates that this dam provides protection in excess of the 100-year flood.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map(s). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

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The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 3).

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood are either close together or coincide, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 8.

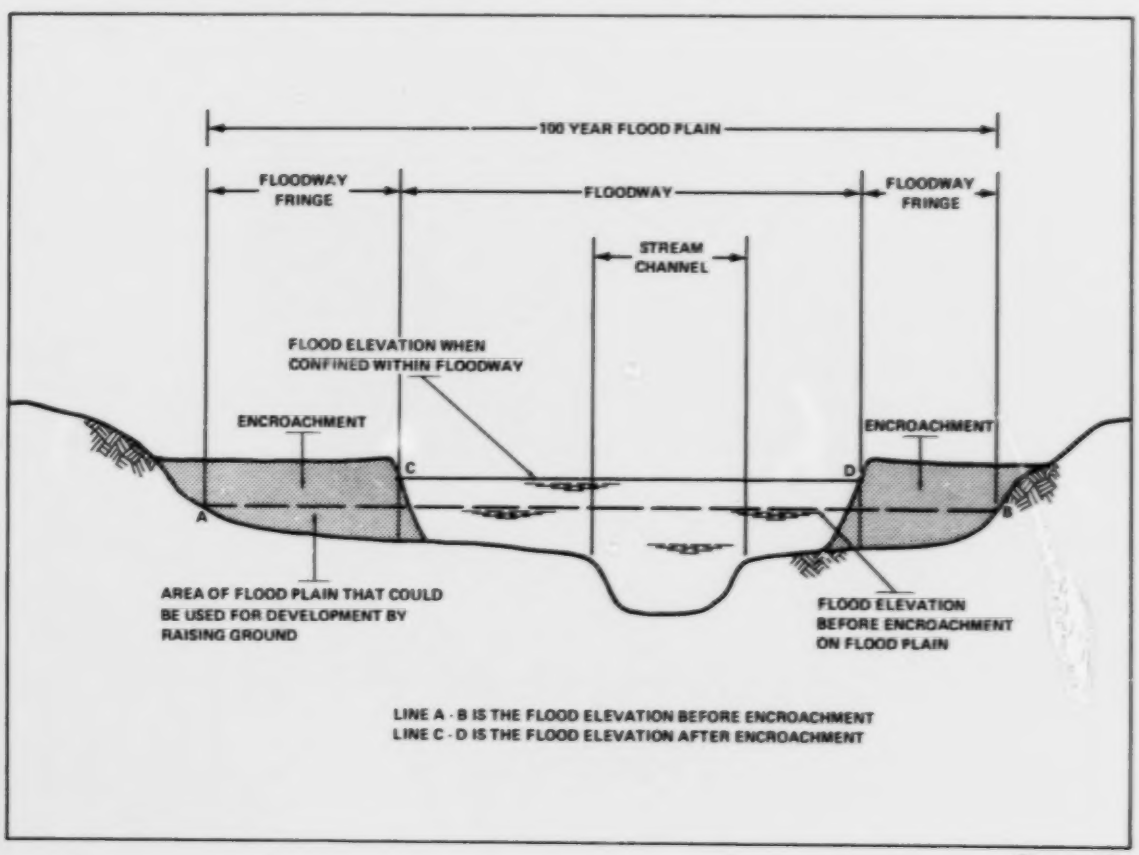

Figure 8

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
NORTH PLATTE RIVER								
A	2,069,425	295	2,752	5.2	5,097.3	5,097.3	5,097.7	0.4
B	1,0871,125	370	3,783	3.8	5,098.4	5,098.4	5,099.0	0.6
[illegible]	2,073,700	275	2,697	5.3	5,099.7	5,099.7	5,100.5	0.8
D	2,077,475	235	2,534	5.7	5,]03.2	5,]03.2	5,]03.7	0.5
E	2,081,100	300	3,198	4.5	5,106.1	5,106.1	5,106.4	0.3
F	2,082,200	200	2,660	5.4	5,106.9	5,106.9	5,107.2	0.3
G	2,085,275	235[2]	2,846	5.1	5,109.9	5,109.9	5,110.7	0.8
H	2,087,400	335[3]	3,842	3.8	5,111.6	5,111.6	5,112.0	0.4
I	2,094,775	210[3]	1,967	6.3	5,117.9	5,117.9	5,118.0	0.1
J	2,096,800	480[3]	3,559	3.5	5,119.1	5,119.1	5,119.8	0.7
K	2,104,900	350	2,930	4.2	5,124.4	5,124.4	5,125.4	1.0
L	2,108,850	450[3]	3,345	3.7	5,127.1	5,127.1	5,128.1	1.0
M	2,112,150	360[3]	3,275	3.8	5,129.2	5,129.2	5,130.2	1.0
N	2,117,000	290[2]	3,040	4.1	5,132.6	5,132.6	5,133.3	0.7
O	2,122,050	260[2]	2,315	5.4	5,136.5	5,136.5	5,137.0	0.5
P	2,126,750	240[3]	2,615	4.7	5,139.9	5,139.9	5,140.7	0.8
Q	2,129,175	350[3]	3,360	3.7	5,141.5	5,141.5	5,142.1	0.6
GARDEN CREEK								
A	4,250	40	205	8.40	5,148.4	5,148.4	5,149.1	0.7
B	5,200	100	210	8.20	5,157.1	5,157.1	5,157.1	0.0
C	5,600	100	210	8.30	5,164.9	5,164.9	5,164.9	0.0
D	6,680	55	244	6.50	5,189.3	5,189.3	5,189.3	0.5
E	7,280	85	182	8.70	5,197.7	5,197.7	5,197.7	0.0
F	7,700	55	160	9.90	5,207.0	5,207.0	5,207.0	0.0

[1]Feet Above Mouth
[2]Floodway Lies Completely Outside Corporate Limits
[3]Floodway Lies Partially Outside Corporate Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

FLOODWAY DATA

NORTH PLATTE RIVER-GARDEN CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
GARDEN CREEK (continued)								
G	8,620	45	156	10.10	5,227.4	5,227.4	5,227.4	0.0
H	9,300	170	349	4.50	5,238.4	5,238.4	5,238.4	0.0
I	9,800	85	269	5.90	5,244.5	5,244.5	5,244.5	0.0
J	10,180	70	174	9.10	5,251.4	5,251.4	5,251.4	0.0
K	10,750	110	237	6.70	5,258.4	5,258.4	5,258.4	0.0
L	11,400	55	255	6.20	5,263.0	5,263.0	5,263.0	0.0
M	12,400	55	222	7.10	5,284.0	5,284.0	5,284.0	0.5
N	13,080	65	170	9.30	5,293.7	5,293.7	5,293.7	0.0
O	13,560	35	141	11.2	5,304.0	5,304.0	5,304.0	0.0
P	14,640	75	184	8.6	5,330.2	5,330.2	5,330.2	0.0
Q	15,300	110	205	7.70	5,345.0	5,345.0	5,345.0	0.0
R	16,160	215	206	7.70	5,367.2	5,367.2	5,368.2	1.0
S	16,800	65	170	9.30	5,376.0	5,376.0	5,376.0	0.0
T	17,510	50	200	7.5	5,392.1	5,392.1	5,393.1	1.0
U	18,290	65	220	6.5	5,407.7	5,407.7	5,408.2	0.5
V	18,950	40[3]	170	8.5	5,430.7	5,430.7	5,431.6	0.9
SAGE CREEK								
A	3,050	50	138	6.60	5,112.6	5,112.6	5,113.2	0.6
B	4,700	103	408	2.23	5,130.2	5,130.2	5,130.2	0.0
C	5,300	93	142	6.41	5,133.0	5,133.0	5,133.0	0.0
D	5,850	68	124	7.32	5,139.2	5,139.2	5,139.2	0.0
E	6,500	140	141	6.45	5,154.9	5,154.9	5,154.9	0.0
F	7,100	70	122	7.48	5,160.8	5,160.8	5-160.8	0.0

[1]Feet Above Mouth
[2]Floodway Lies Partially Outside Corporate Limits
[3]Floodway Lies Completely Outside Corporate Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

FLOODWAY DATA

GARDEN CREEK-SAGE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
SAGE CREEK (continued)								
G	7,575[1]	52	110	8.28	5,166.1	5,166.1	5,166.1	0.0
H	8,575[1]	138	144	6.33	5,174.6	5,174.6	5,174.6	0.0
I	9,375[1]	65	154	5.91	5,184.2	5,184.2	5,185.0	0.8
J	10,100[1]	36	105	8.70	5,194.0	5,194.0	5,194.1	0.1
K	10,925[1]	70	172	5,29	5,200.8	5,200.8	5,200.8	0.0
L	11,600[1]	43	111	8.23	5,207.6	5,207.6	5,208.0	0.4
M	12,100[1]	50[2]	122	5.41	5,211.1	5,211.1	5,212.1	1.0
N	14,860[1]	25[2]	90	10.0	5,245.7	5,245.7	5,245.7	0.0
O	15,785[1]	90[2]	225	4.0	5,256.2	5,256.2	5,257.2	1.0
SQUAW CREEK								
A	340[3]	25	50	16.8	5,134.0	5,134.0	5,134.0	0.0
B	630[3]	25	60	14.0	5,145.7	5,145.7	5,145.7	0.0
C	680[3]	30	75	11.2	5,148.0	5,148.0	5,148.0	0.0
D	1,730[3]	40	60	14.0	5,188.3	5,188.3	5,188.3	0.0
WOLF CREEK								
A	370[3]	90	465	2.3	5,134.5	5,134.5	5,135.5	1.0

[1] Feet Above Mouth
[2] Floodway Lies Partially Outside Corporate Limits
[3] Feet Above Confluence With North Platte River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

FLOODWAY DATA

SQUAW CREEK-WOLK CREEK

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5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the City of Casper.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

Eleven reaches meeting the above criteria were required for the flooding sources affecting Casper.

These include the North Platte River and Garden Creek which required three reaches. Sage Creek and Wolf Creek required two reaches and Squaw Creek was contained within one reach. The location of the reaches are shown on the Flood Profiles.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

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5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Casper was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A1, A2, A3, A4, A5, A6, A10, and A11.	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 4, "Flood Insurance Zone Data", summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Casper is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
NORTH PLATTE RIVER							
Reach 1	0005,0010	-2.8	-0.9	+7.2	030	A6	Varies - See Map
Reach 2	0010	-2.1	-0.8	+5.8	020	A4	Varies - See Map
Reach 3	0010	-2.7	-1.9	+8.4	025	A5	Varies - See Map
GARDEN CREEK							
Reach 1	0010	-0.3	0.0	0.0	005	A1	Varies - See Map
Reach 2	0010,0015	-2.6	-0.9	+3.0	025	A5	Varies - See Map
Reach 3	0010	-2.0	-0,8	+1.4	020	A4	Varies - See Map
SAGE CREEK							
Reach 1	0005,0015	-1.2	-0.8	+2.6	010	A2	Varies - See Map
Reach 2	0015	-1.3	-0.3	0.6	015	A3	Varies - See Map
SQUAW CREEK							
Reach 1	0010	-1.4	-0.4	+0.8	015	A3	Varies - See Map
WOLF CREEK							
Reach 1	0010	-1.3	-0.3	2.4	015	A3	Varies - See Map
Reach 2	0010	-5.5	-1.7	6.7	055	A11	Varies - See Map
SHALLOW FLOODING AREA	0010	NA	NA	NA	NA	A0	Depth 2

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

FLOOD INSURANCE ZONE DATA

6.0 OTHER STUDIES

Flood Plain Information reports were prepared for the North Platte River, Garden Creek, and Sage Creek and were published in March 1973, February 1969, and April 1970, respectively. They are indicated as References 3, 1, and 2, respectively. The base flood elevations, flood profiles, and flood boundaries contained in this study are essentially the same as those presented in the respective Flood Plain Information reports.

Differences occur in areas that have experienced a physical change in the flood plain configuration between the dates of this report and the respective Flood Plain Information report.

This Flood Insurance Study is authoritative for purpose of the Flood Insurance Program. Data presented here either supersede or are compatible with that presented in earlier studies.

This report supersedes the previous Flood Insurance Study (Reference) and should be considered authoritative for purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Chief, Natural and Technological Hazards Division, Federal Emergency Management Agency, Denver Federal Center, Building 710, Lakewood, Colorado 80225.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Army Corps of Engineers, Omaha District, Flood Plain Information, Garden Creek, Volume I, Casper, Wyoming, February 1969

2. ----------, Flood Plain Information, Sage Creek, Volume II, Casper, Wyoming, April 1970

3. ----------, Flood Plain Information, North Platte River, Volume III, Casper, Wyoming, March 1973

4. U.S. Department of Agriculture, Soil Conservation Service, Investigation Report on Casper Mountain Drainages, Natrona County, Wyoming, Casper, Wyoming, May 1974

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6. Missouri River Basin Comprehensive Framework Study, Task Force of Federal Agencies on Generalized Streamflow Probabilities, April 1967

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8. U.S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, Hydraulics of Bridge Waterways, Washington, DC, 1970

9. U.S. Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 feet: Casper, Wyoming (1971)

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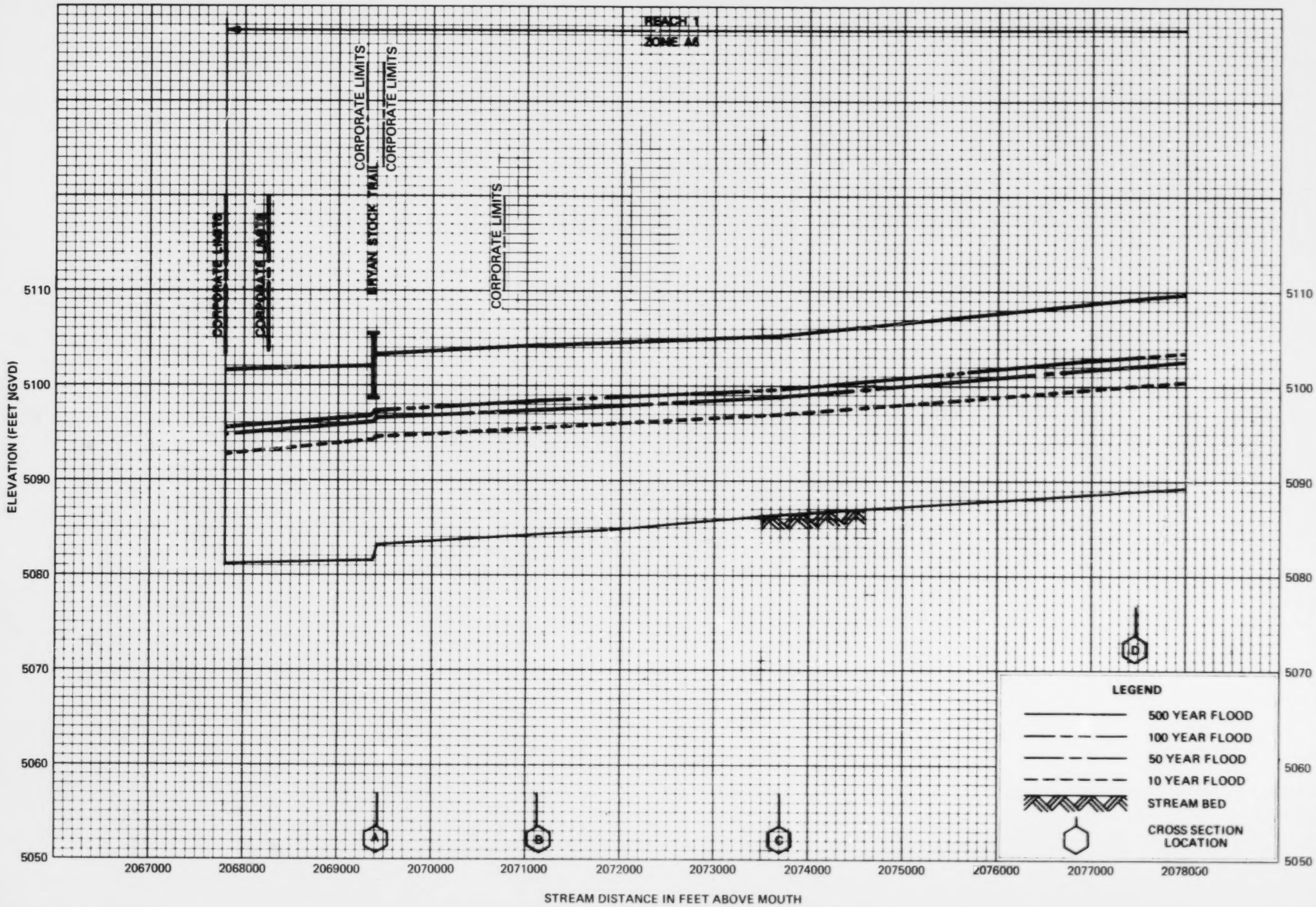

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

01P

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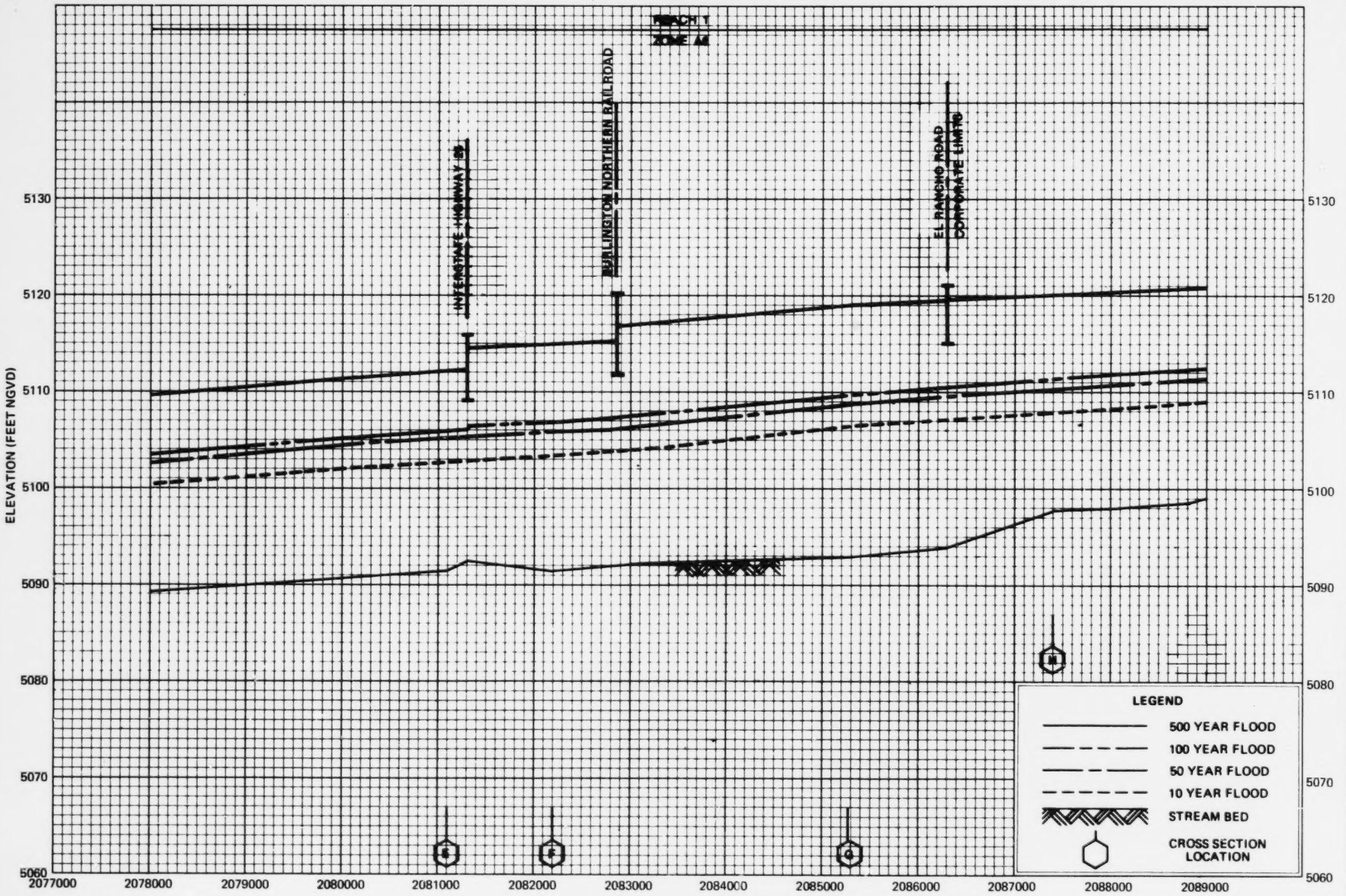

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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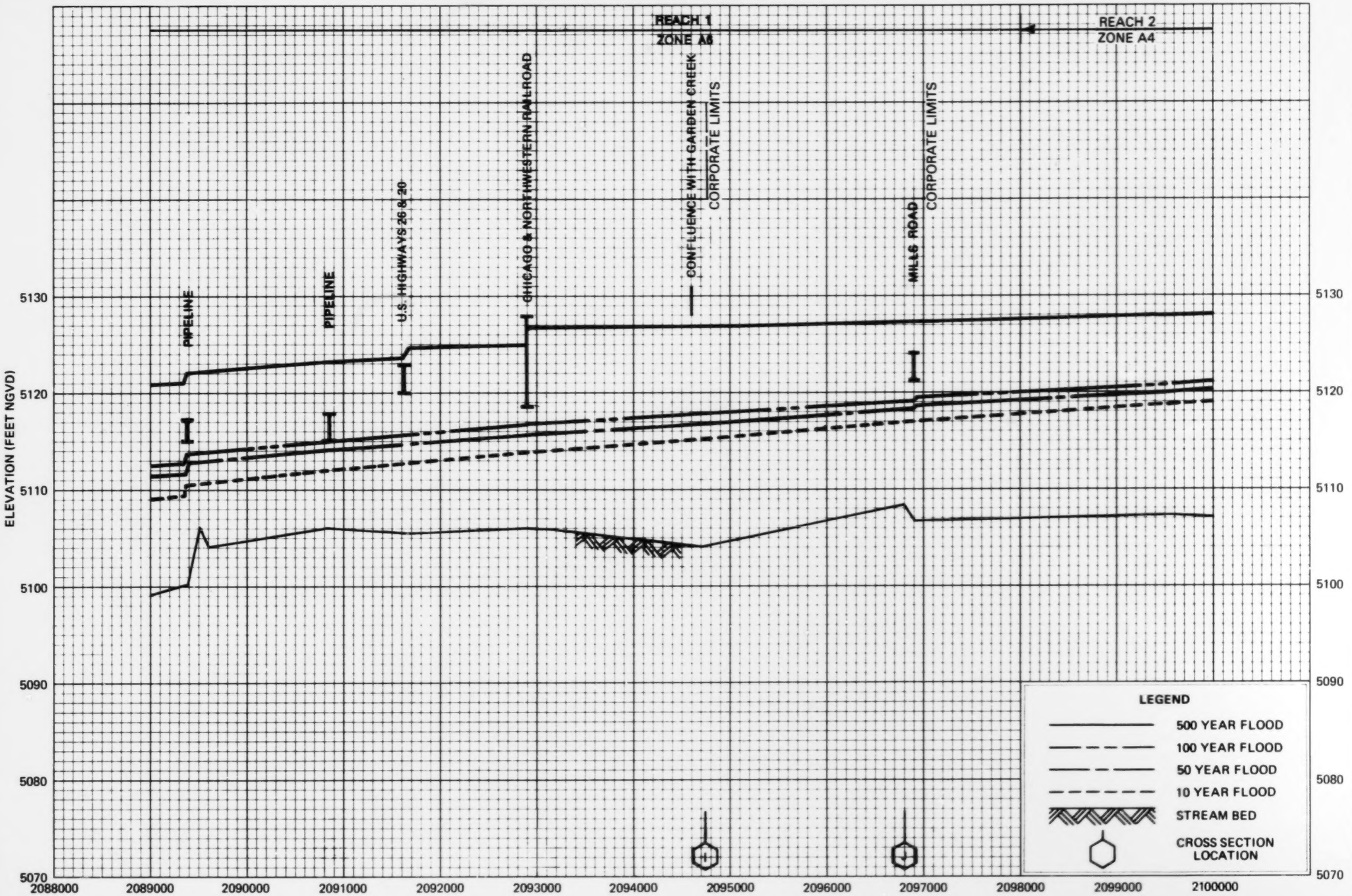

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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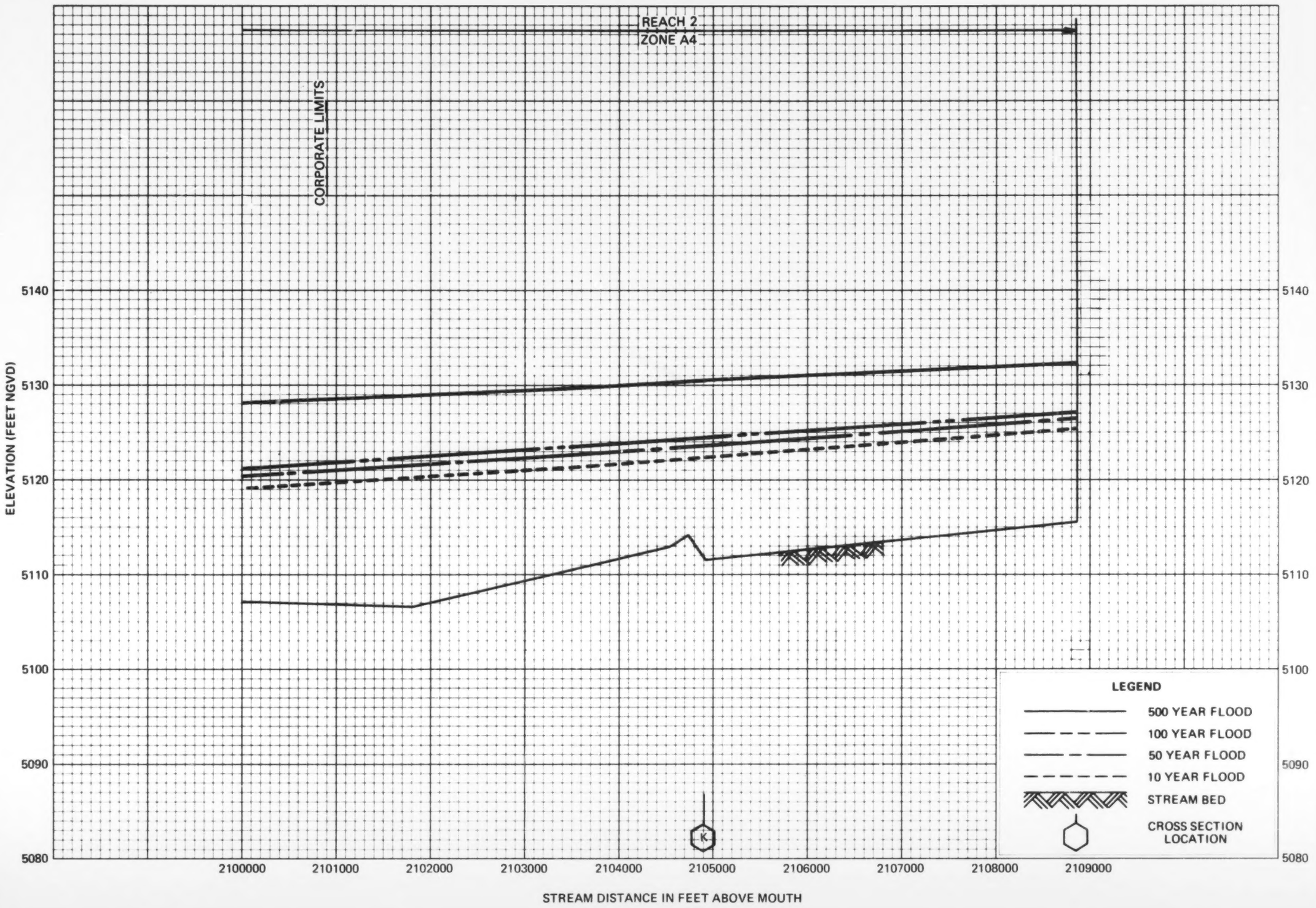

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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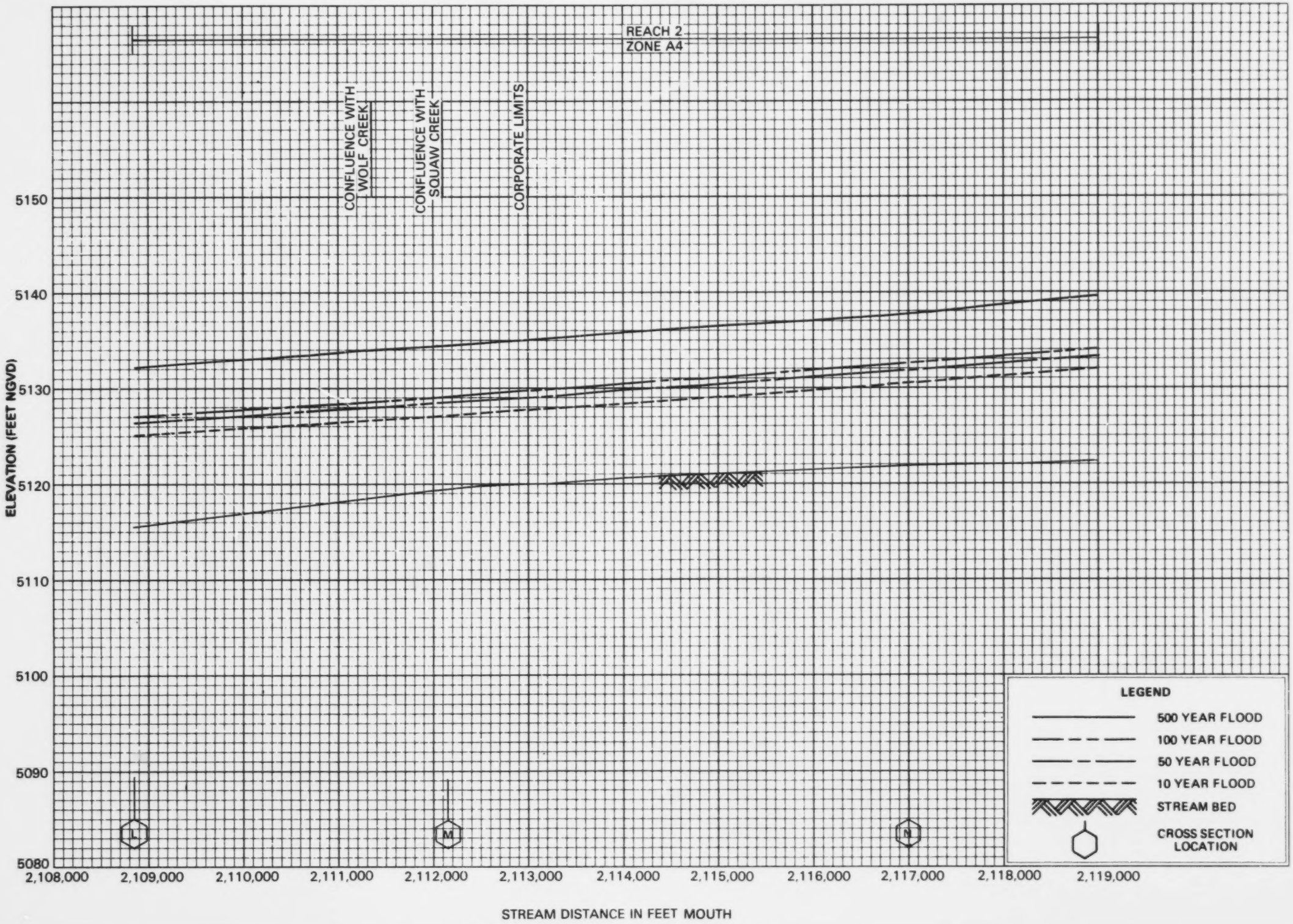

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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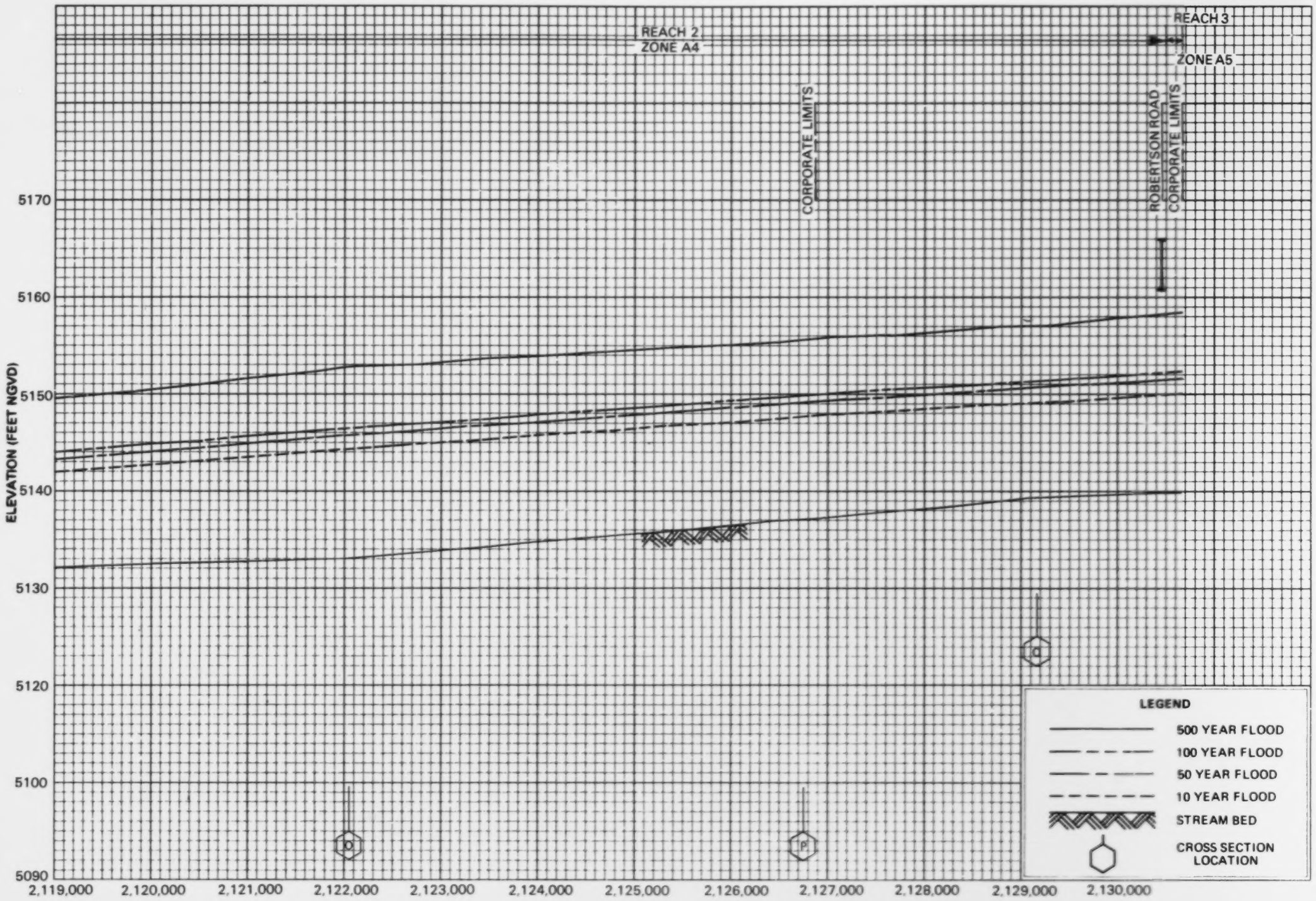

FLOOD PROFILES

NORTH PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

06P

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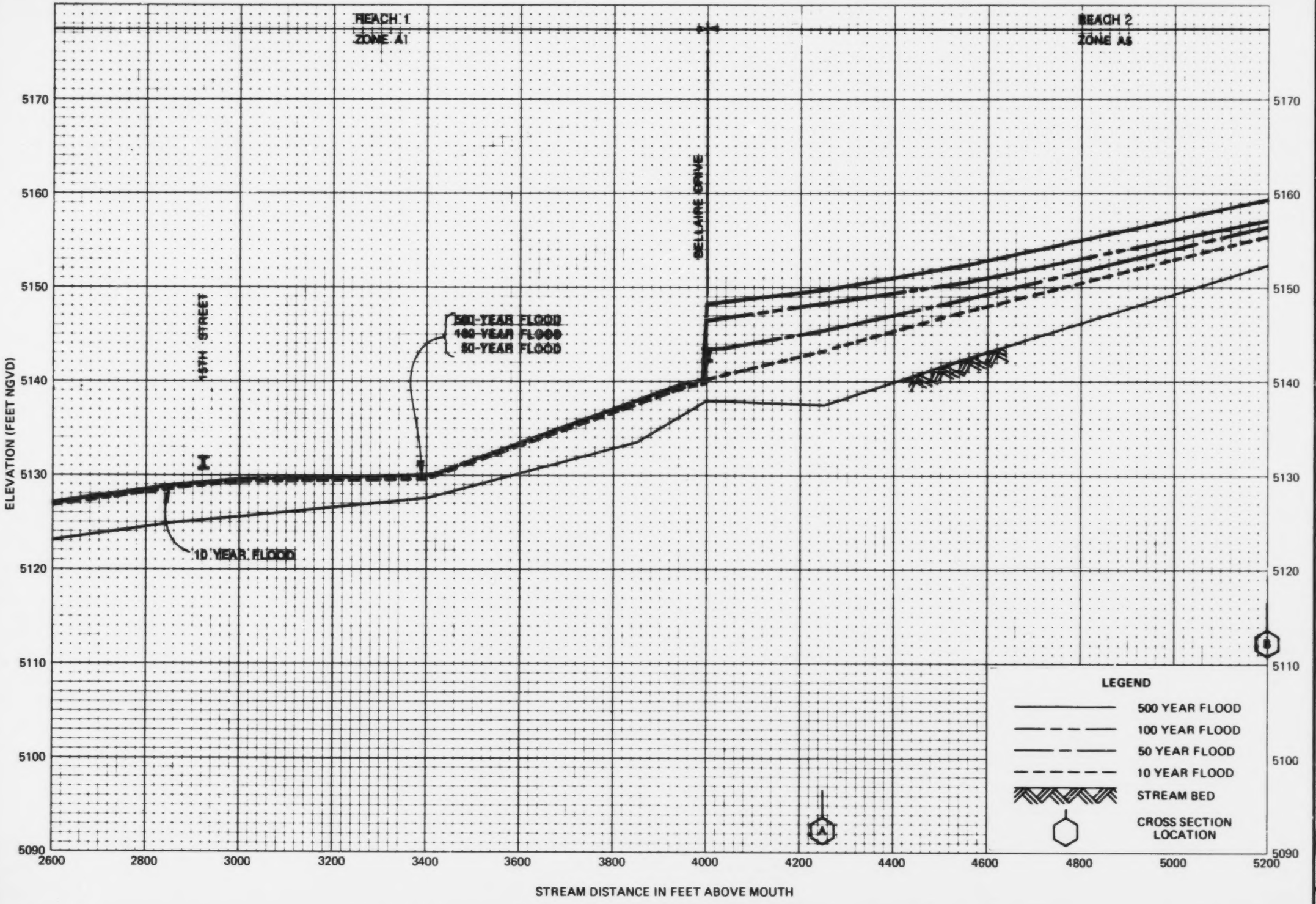

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

07P

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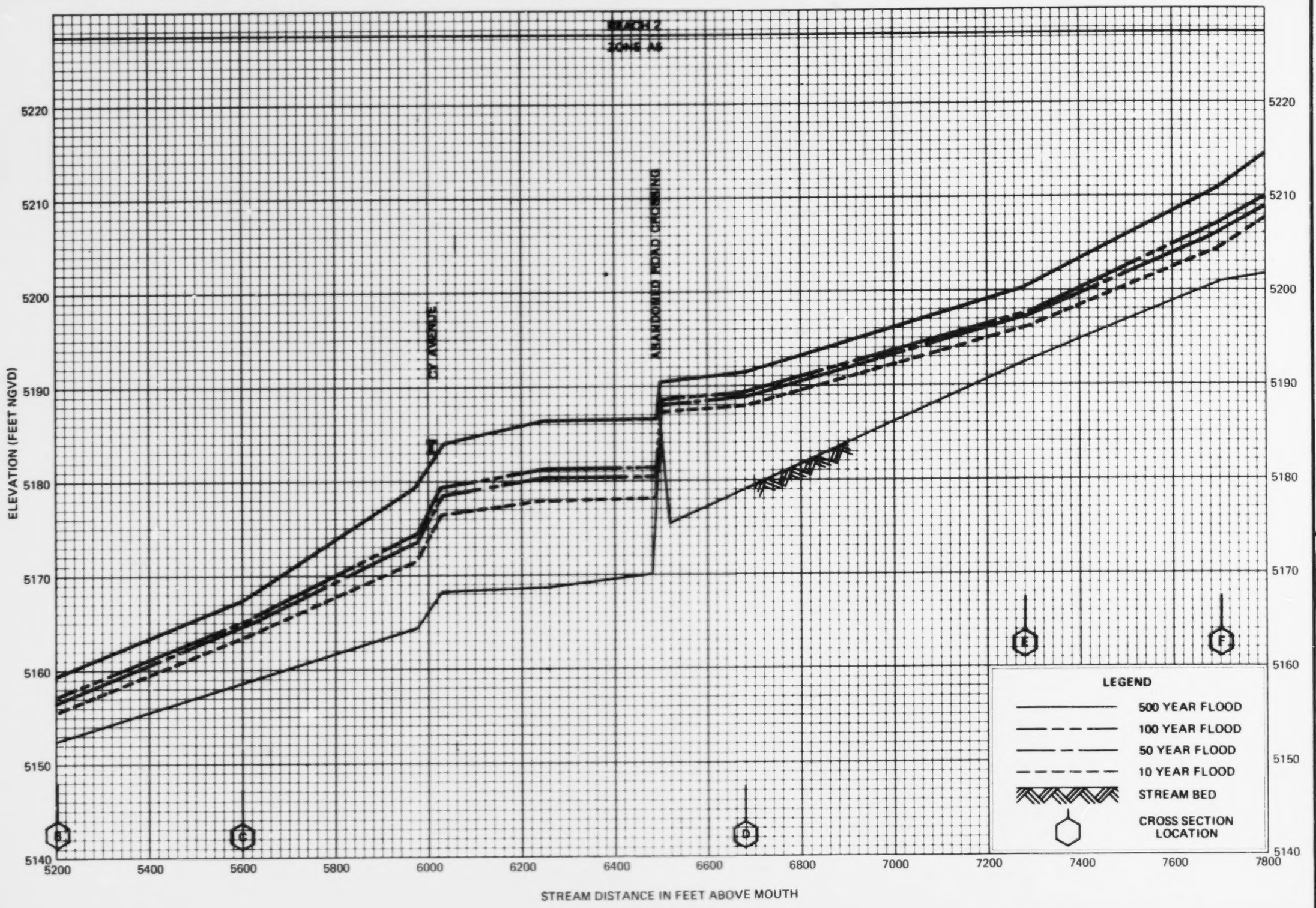

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

08P

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REACH 2
ZONE AS

ELEVATION (FEET NGVD)

5260
5250
5240
5230
5220
5210
5200
5190

26TH STREET

23RD STREET

7800 8000 8200 8400 8600 8800 9000 9200 9400 9600 9800 10000 10200 10400

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND
- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

09P

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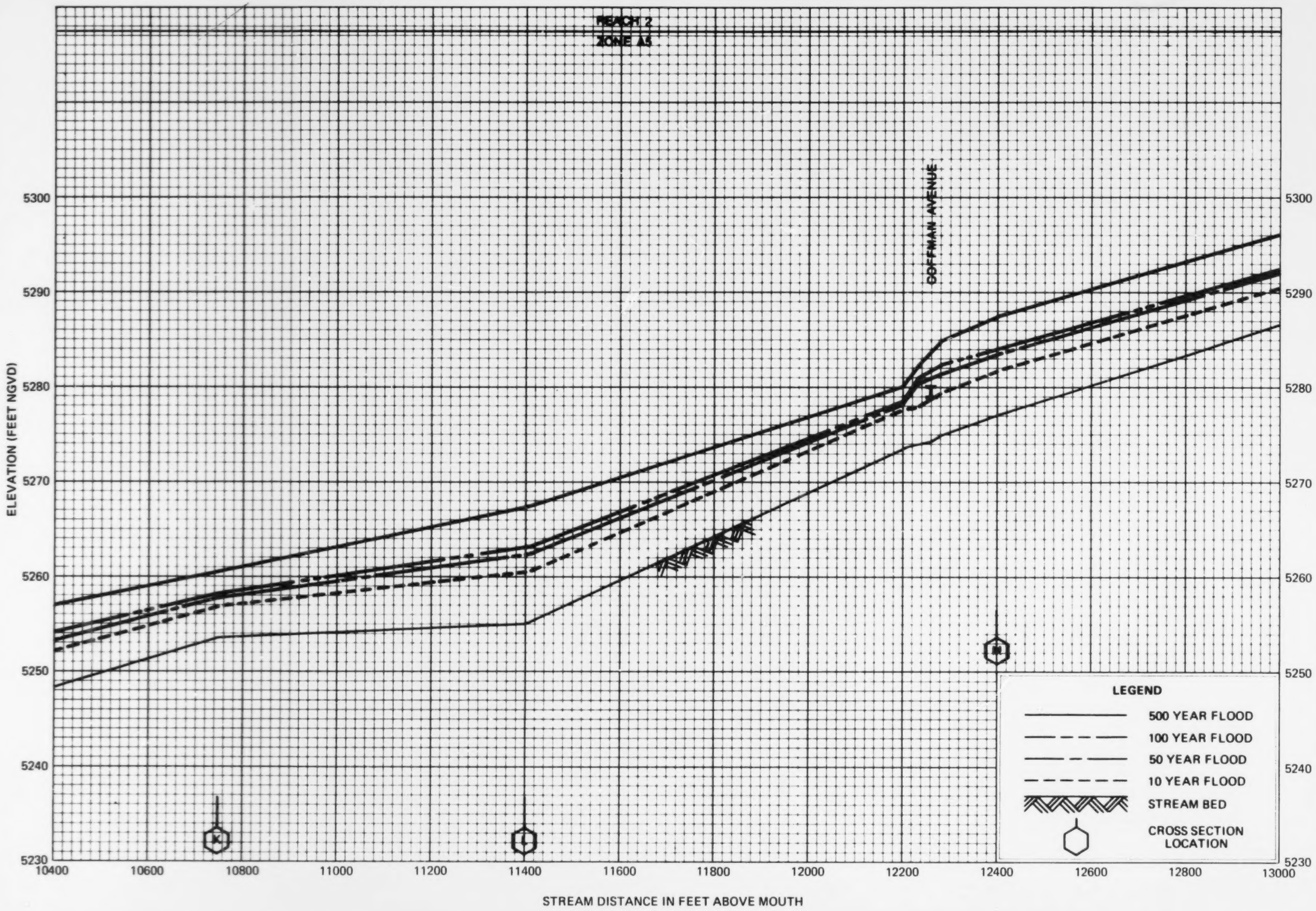

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

10P

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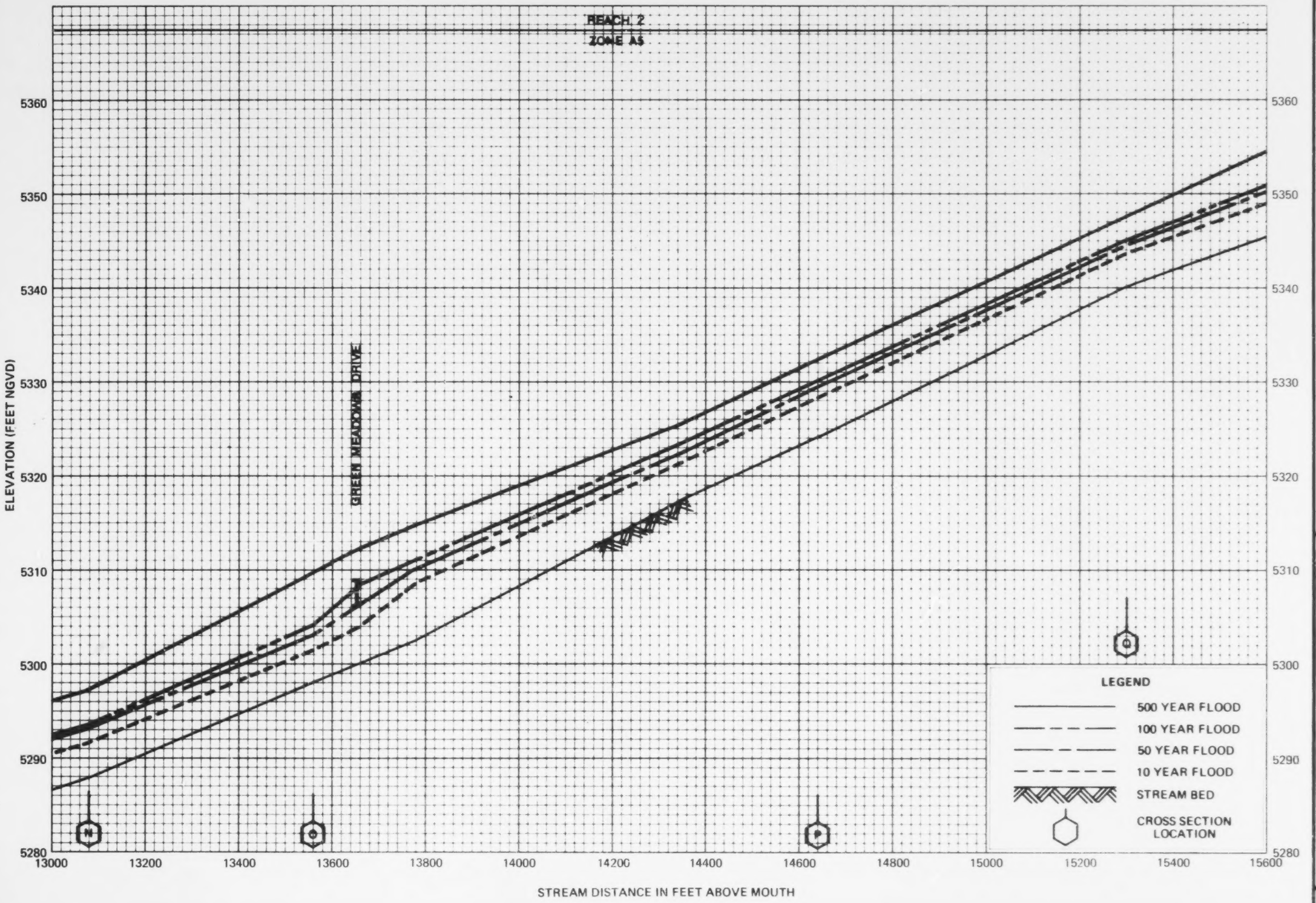

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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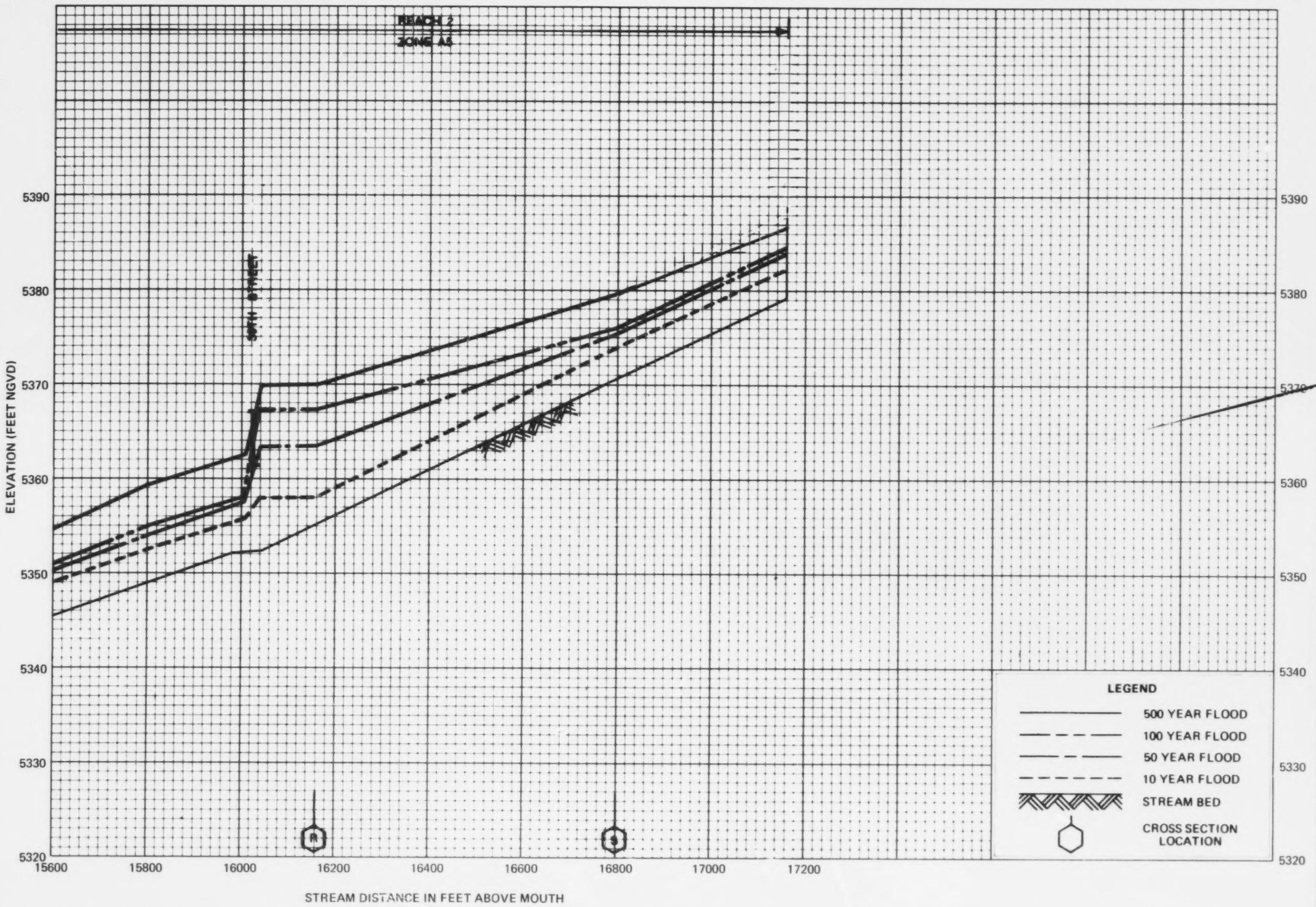

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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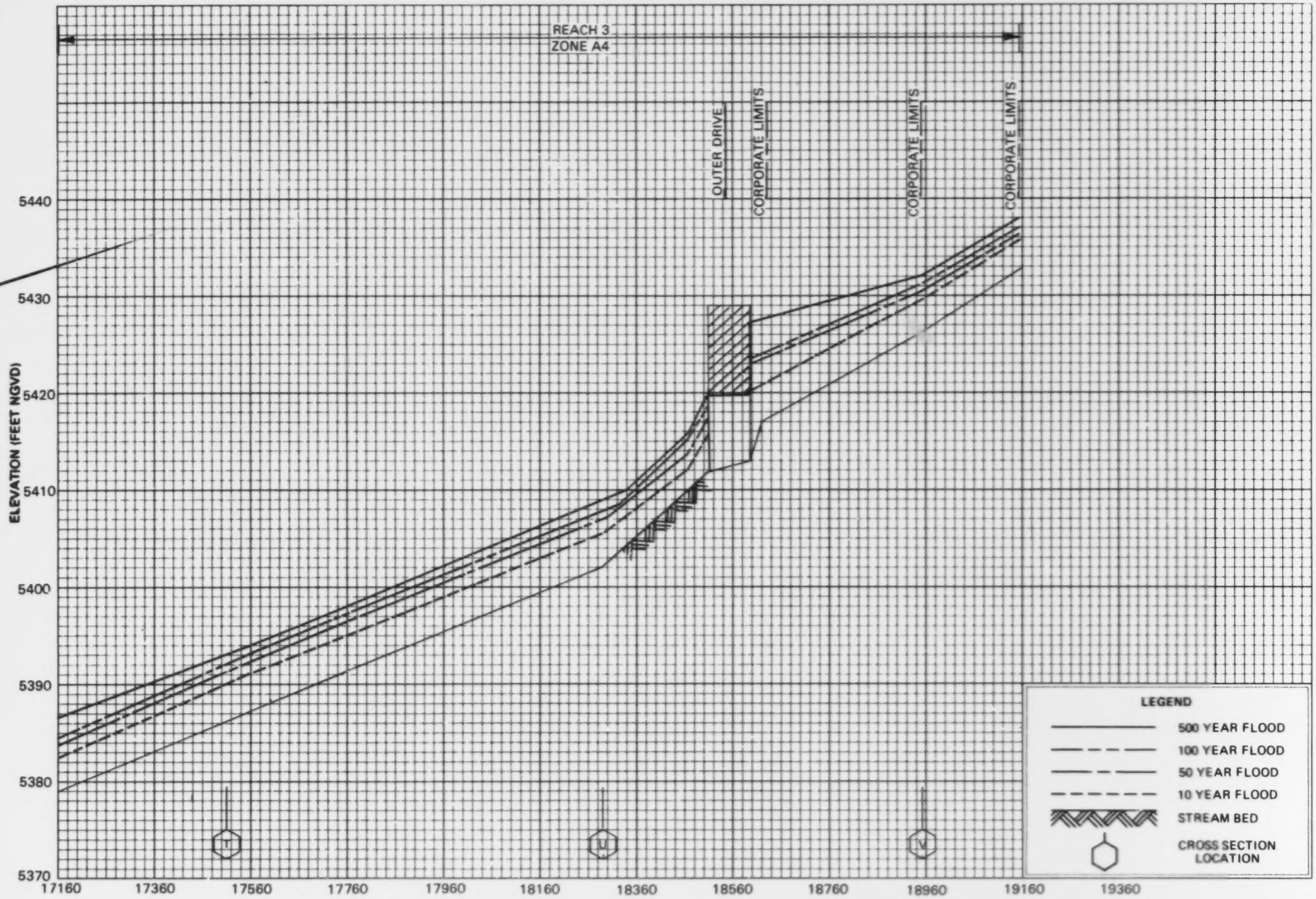

FLOOD PROFILES

GARDEN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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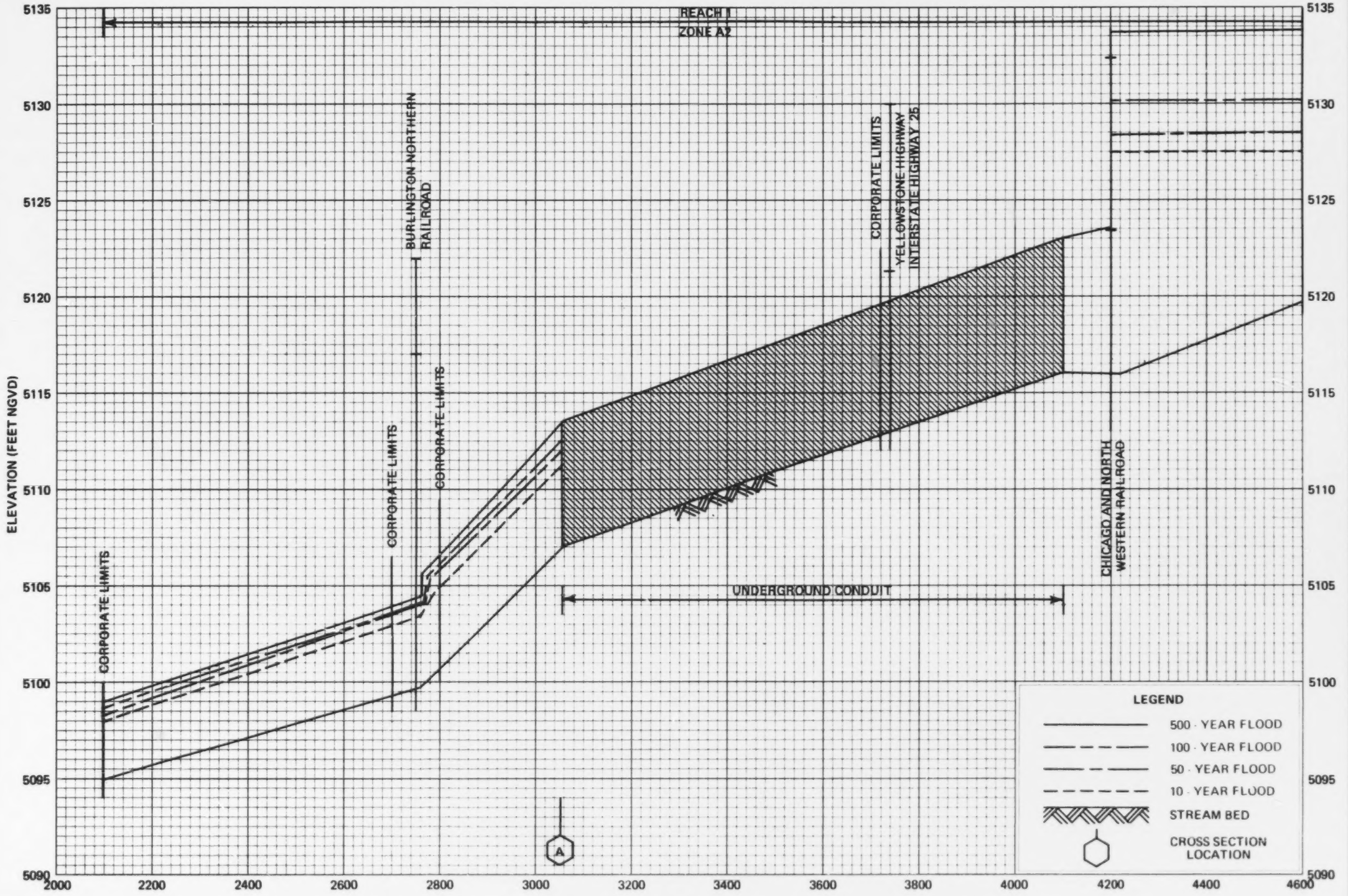

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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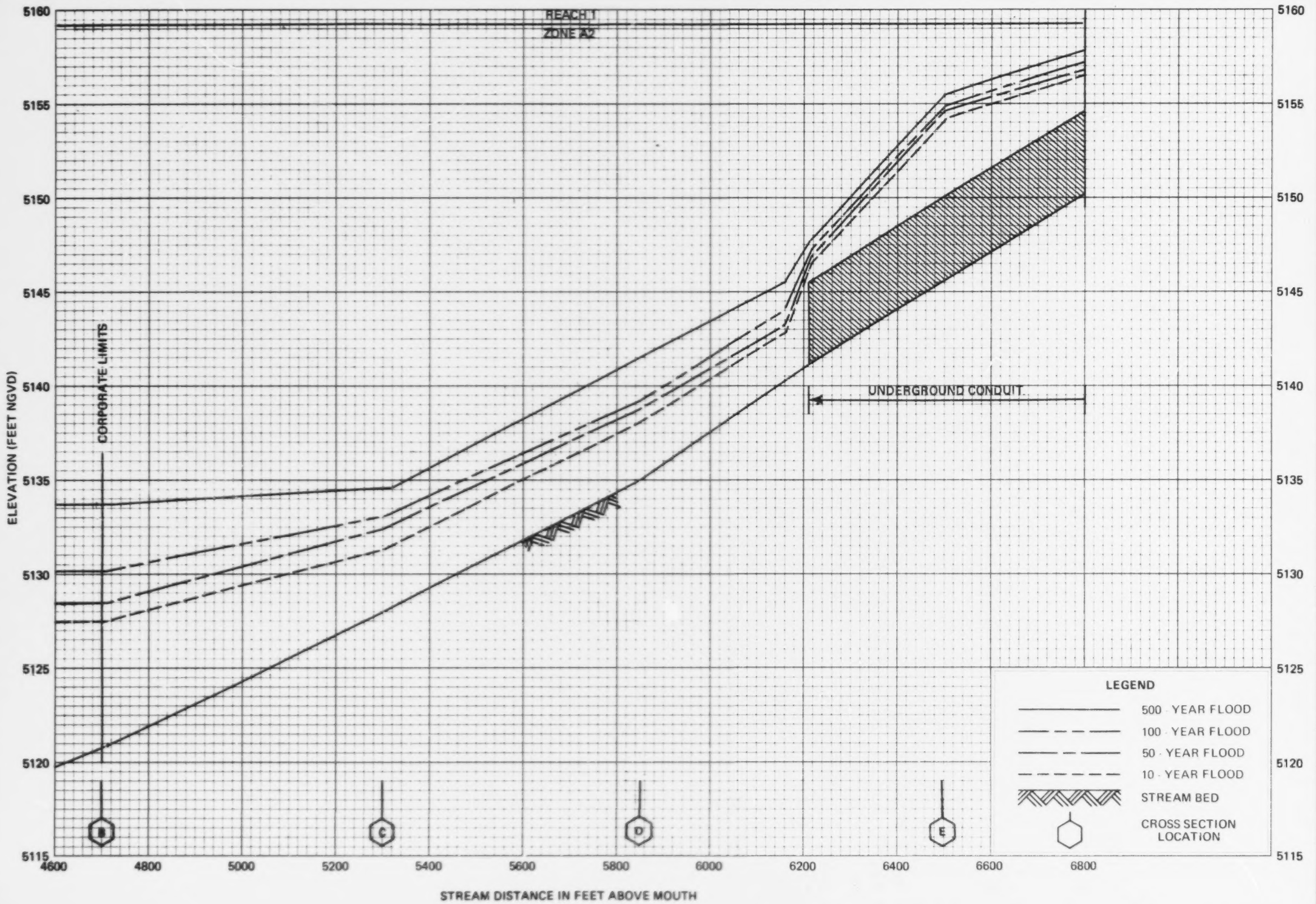

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

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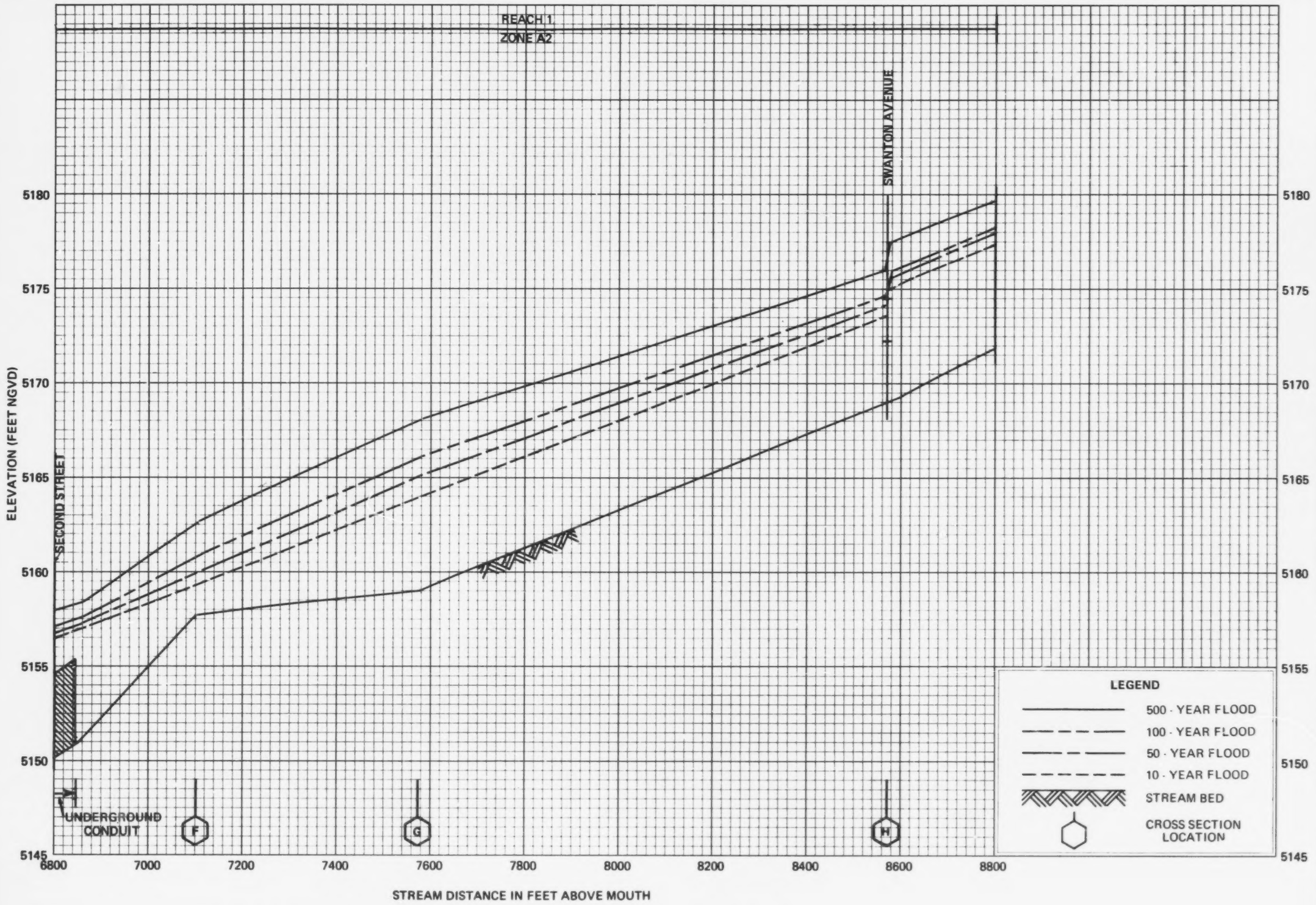

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

16P

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REACH 1
ZONE A2

ELEVATION (FEET NGVD)

5210
5205
5200
5195
5190
5185
5180
5175
5170

8800 9000 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200

STREAM DISTANCE IN FEET ABOVE MOUTH

12TH STREET

I J K

LEGEND
- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

17P

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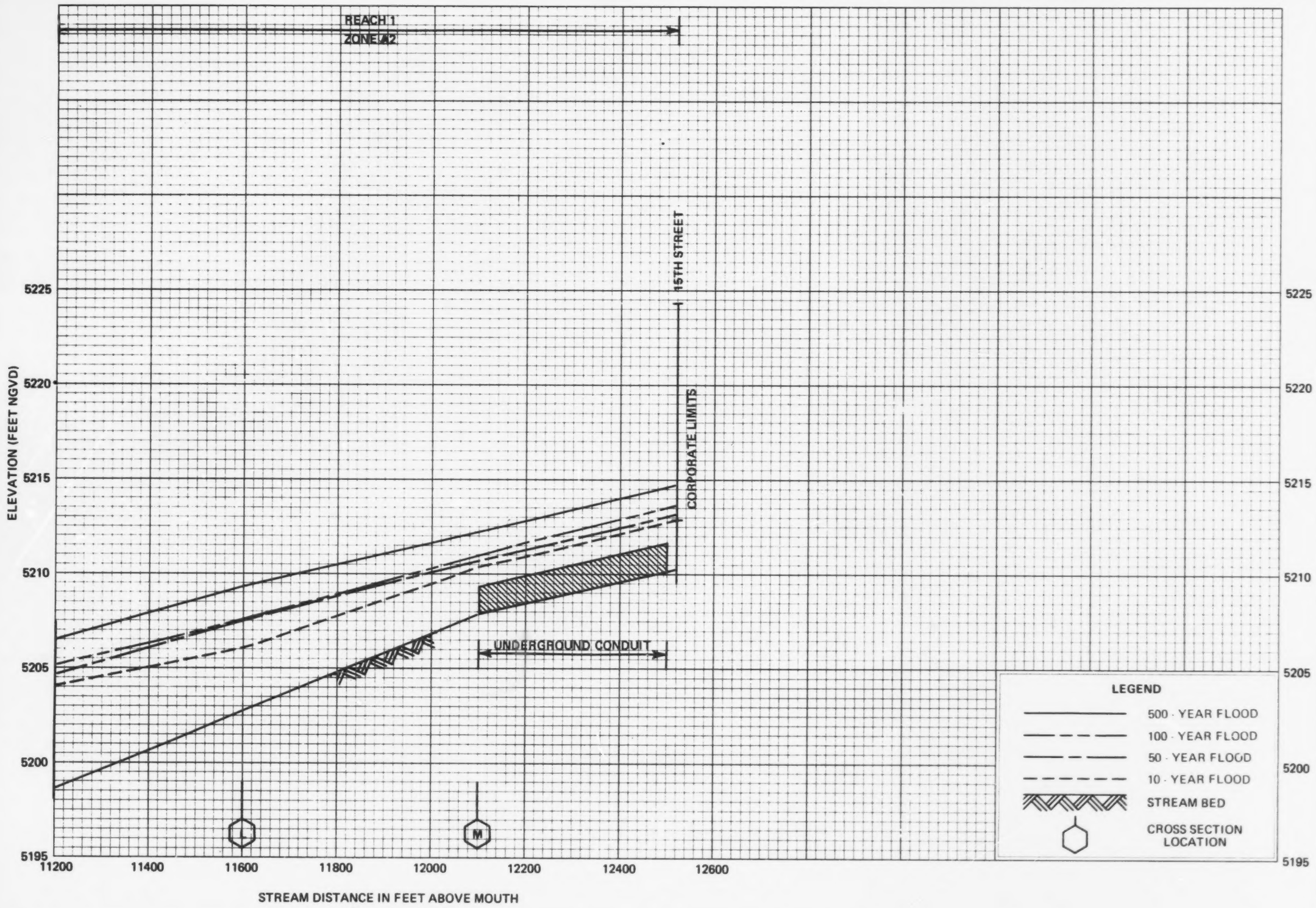

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

18P

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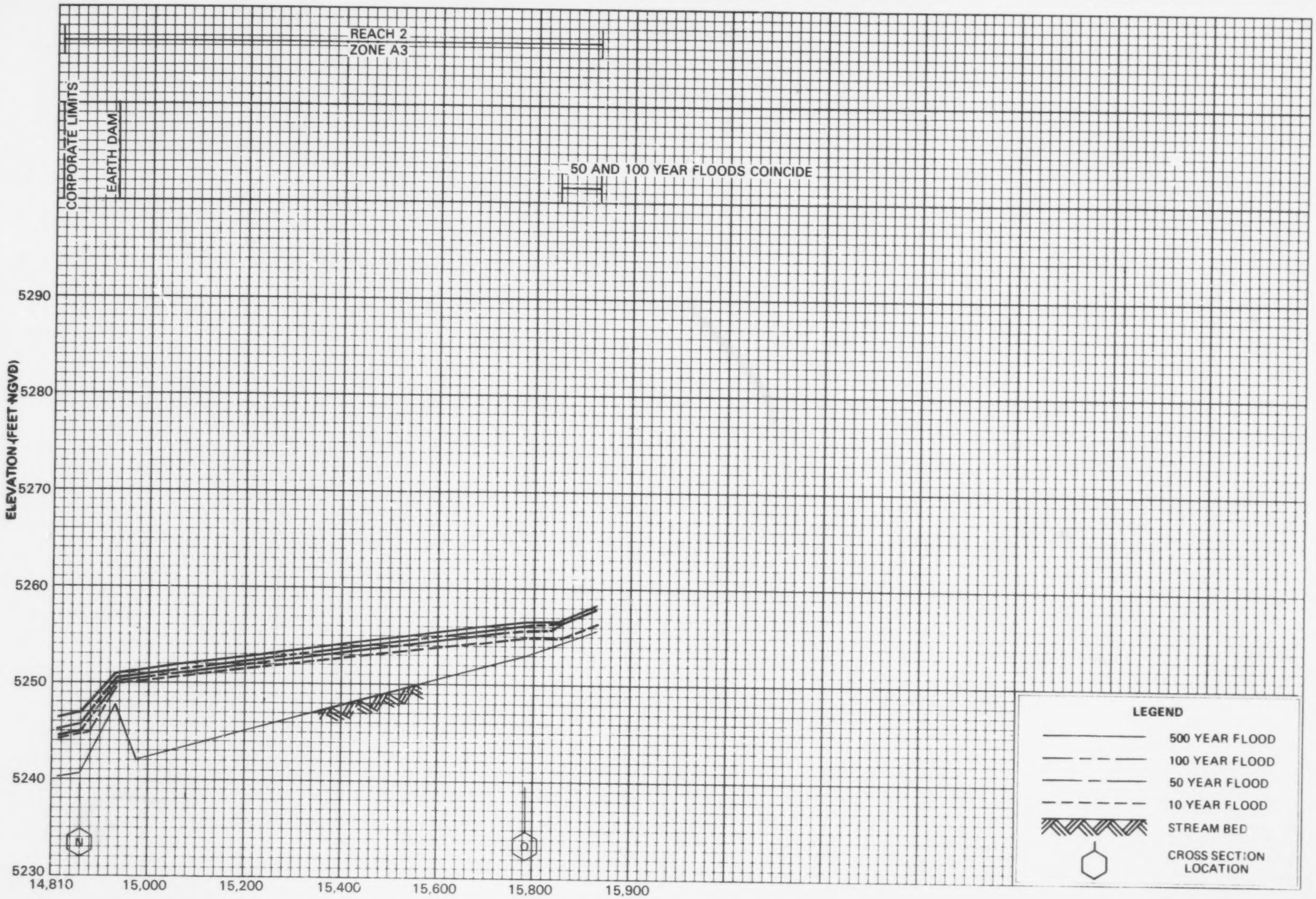

FLOOD PROFILES

SAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

19P

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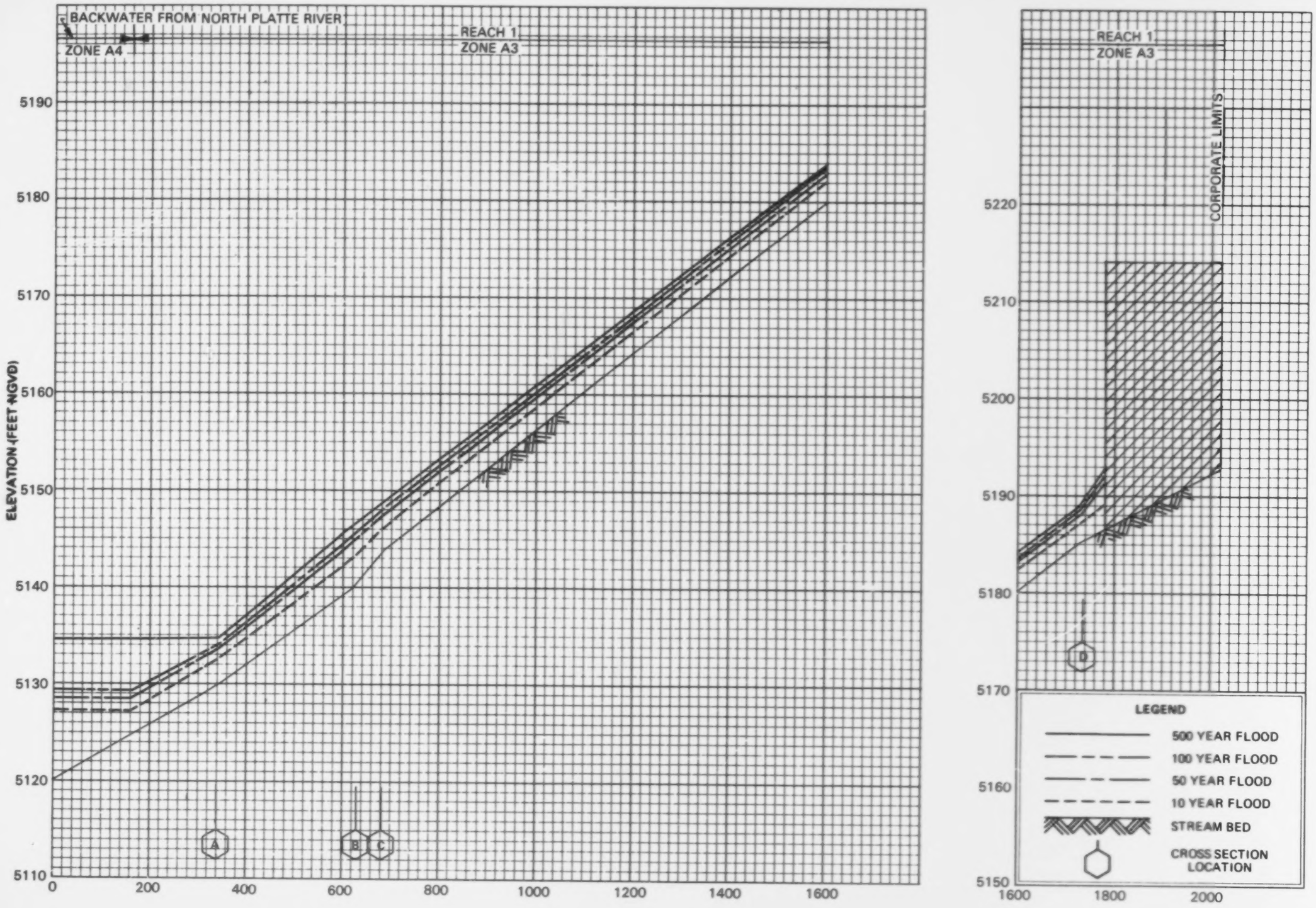

FLOOD PROFILES

SQUAW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

20P

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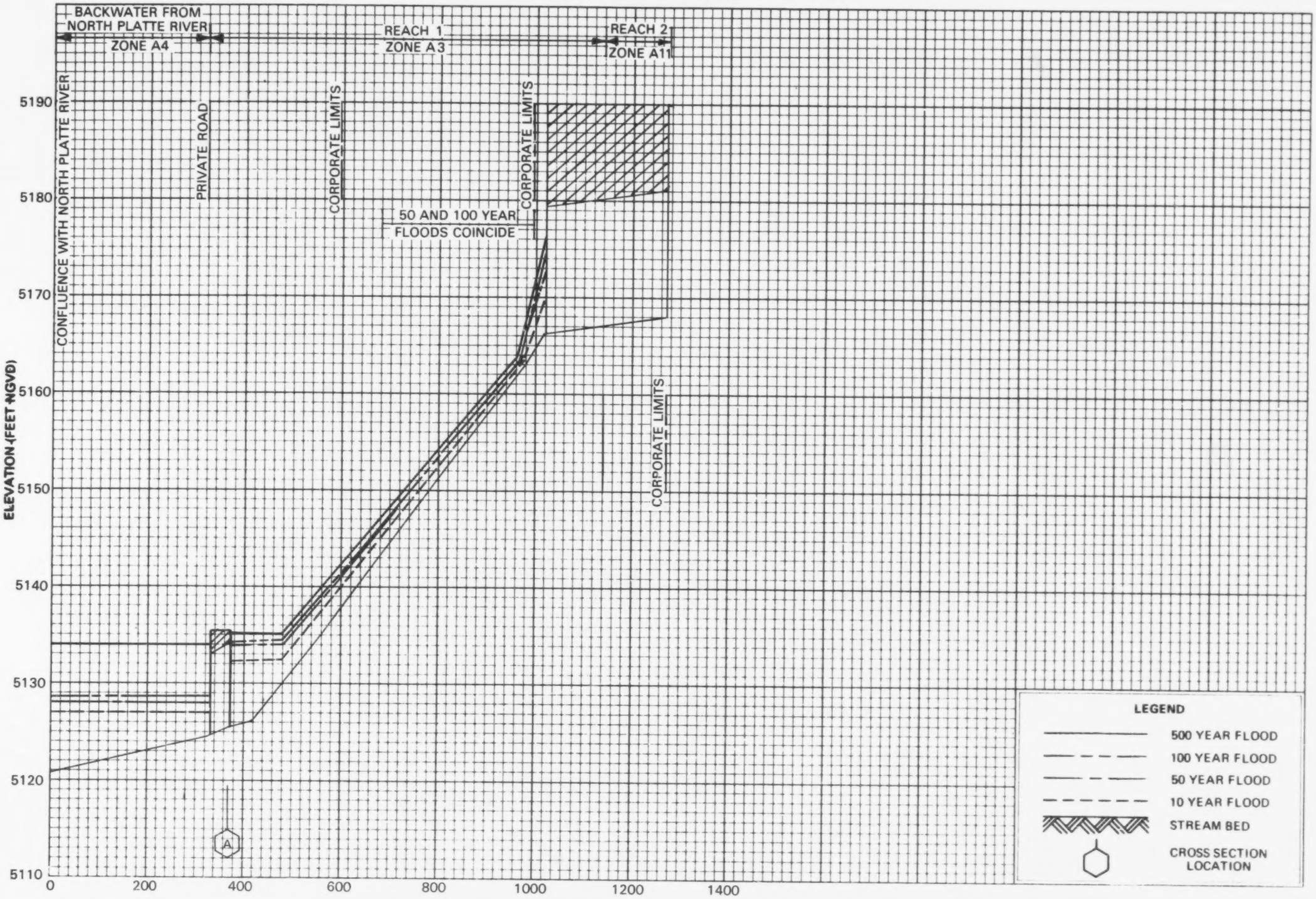

FLOOD PROFILES

WOLF CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CASPER, WY
(NATRONA CO.)

21P